Risk Assessment and Risk Management in Aviation Decision Making

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Two studies were conducted to determine the types of risk that are of greatest concern to pilots (and thus most influence the perceived difficulty of making a decision) and how they manage such risks. Analyses of air carrier accidents have found that the majority of errors related to the flight crews involved faulty decision making. A common pattern found was crews' continuation with their original plan in the face of changed conditions that suggested another course of action might be more prudent. Many accidents reflected what appeared to be inadequate risk assessment by the crew that led to a decision to take an inappropriate action. Additional factors that might have worked against safe decisions included organizational and social pressures about fuel economy and maintaining on-time departures and arrivals and peer judgments about professional competence. Risk assessments influence crews' decision making during their assessment of a perceived threat that may require intervention and during their evaluation of potential responses to that threat. However, despite its important role in aviation decision making, there has been surprisingly little research on pilots' risk assessment.

Two studies were conducted to examine this topic. In the first, 119 airline pilots were asked about their everyday experience with five types of risk: *economic* (dollar costs to the company), *physical* (safety), *productivity* (disruption of the schedule), *professional* (possible job loss), and *social* (others' impressions). Their responses indicated that pilots are *most concerned* with threats to flight safety, which accounted for 79% of their responses. Figure 1 illustrates the types of physical threats that were mentioned. However, pilots reported *encountering* economic and productivity risks most often. Social and safety risks were rated as least often encountered. Both captains and first officers mentioned that conflicts between safety-related goals and other types, especially customer satisfaction, were most difficult to resolve. Lack of any good options also increased the perceived difficulty of decisions. For captains, difficult decisions were associated with high levels of ambiguity and uncertainty in the decision situation. First officers, on the other hand, attributed greater decision difficulty to the possibility that a poor decision would have negative professional consequences.

A second study examined how pilots respond to goal conflict, ambiguity and uncertainty in dynamic flight situations. Two evolving decision scenarios were presented to each of 30 pilots who were asked to "think aloud" as they decided what to do. In both scenarios, continuing with the original plan to take-off would pose a threat to flight safety but bring economic gains if successful. On the other hand, changes to the original plan would enhance safety but result in economic or other losses. In both scenarios, pilots chose the riskier (in terms of safety) option 50% of the time. Analyses of pilots' verbalized decision-making processes indicated that they did not weigh the consequences of options, but rather tried to control the safety risk associated with their choices. Those who selected "riskier" options invented solutions that allowed them to minimize the safety risk while also achieving productivity goals. Those who took the conservative option avoided the safety risk.

These two studies represent initial efforts to understand the risks that pilots face and why they make decisions as they do. The inherently subjective nature of risk assessment was evident in the differences between crew positions in the risk survey and in the differing interpretations of cues used by pilots in the second study. Subsequent research will seek to improve decision making by developing effective risk-management and decision-making strategies and support tools.